Extra Credit Report.

Submitted by:

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Question:

1. Having fun in Disneyland! A visit at Disneyland involves a fair amount of waiting in lines during the high season. One has to queue up to buy a ticket, and then once in the park, one has to queue up for each theme. Does one spend more time queueing up or enjoying the themes? That depends on the arrival rates of customers and service times (i.e. the time to see a theme). The queueing network in figure 1 depicts the ticket counters, four themes, and the food court. Answer the following questions:

    a. Are all the queues stable?
    b. What is the utilization of each ticket counter?
    c. What is the probability that a customer will get served immediately upon arrival at the food court?
    d. What is the mean waiting time at each theme?
    e. How long would it take on the average to visit all themes once, and of that time how much one spends waiting in a queue?

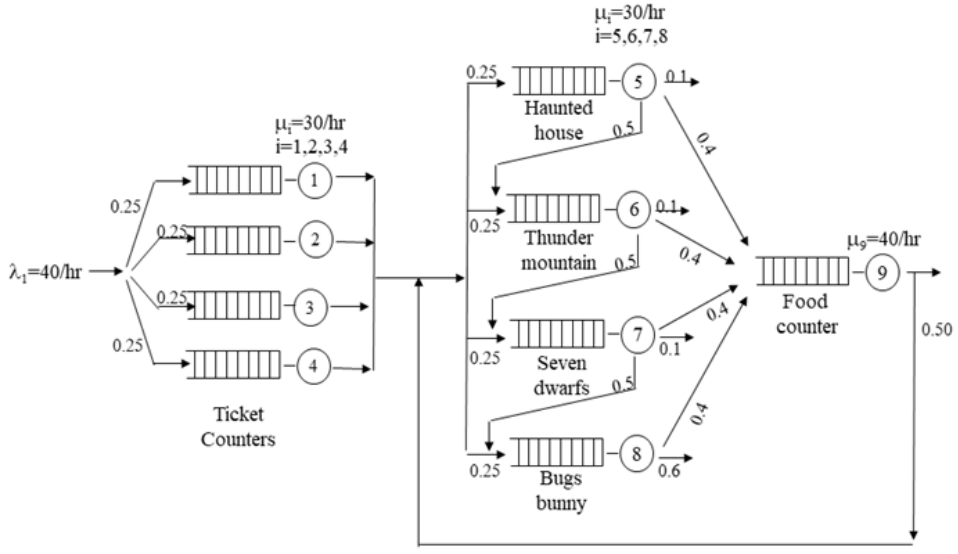


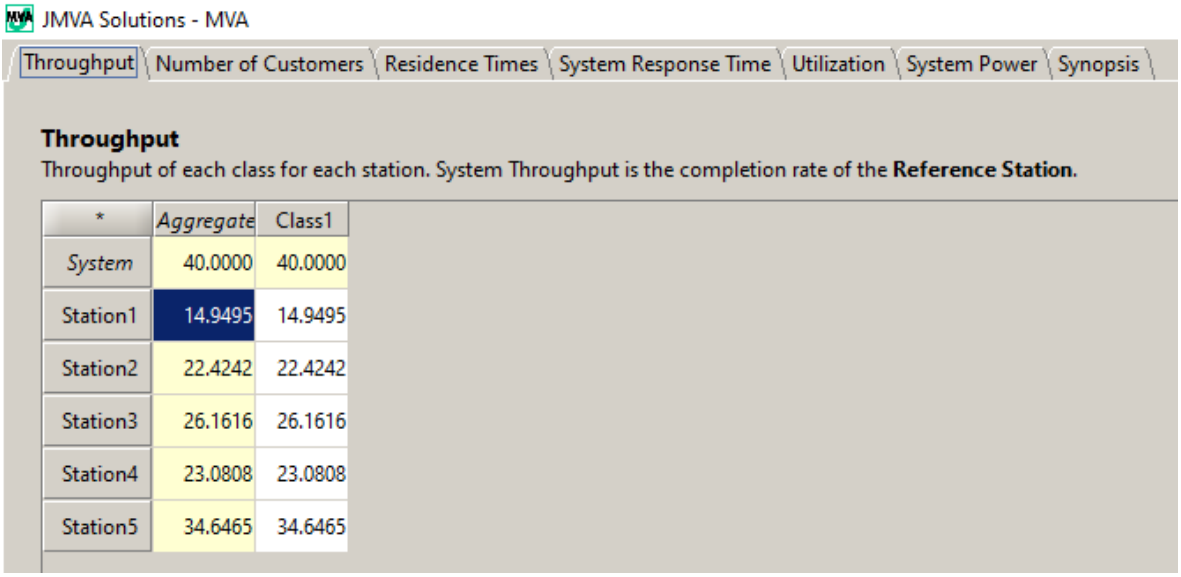
Figure 1: Having fun in Disneyland

Technology Used:

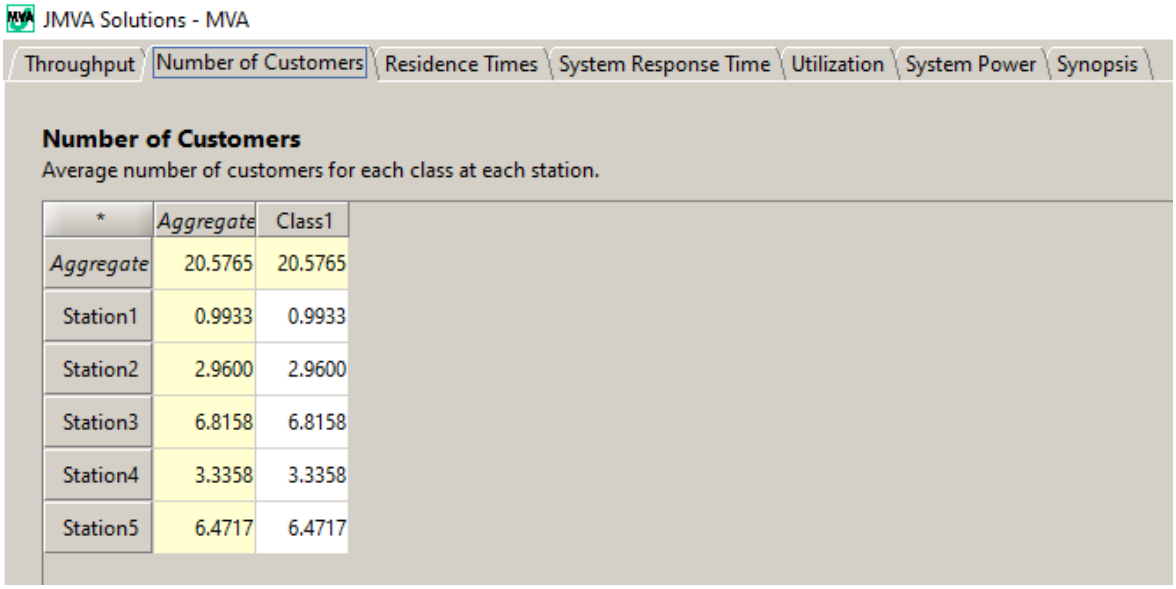
- Simulation was carried out using JMT i.e Java Modeling Tool.

Results:

Results of the simulation are inserted below.



(Throughput Results)



(No of Customers)

JMVA Solutions - MVA

Throughput | Number of Customers | Residence Times | System Response Time | Utilization | System Power | Synopsis

Residence Times

Total time spent by each customer class summed across all visits to a station.

*	*Aggregate*	Class1
Station1	0.0248	0.0248
Station2	0.0740	0.0740
Station3	0.1704	0.1704
Station4	0.0834	0.0834
Station5	0.1618	0.1618

(Residence Times)

JMVA Solutions - MVA

Throughput | Number of Customers | Residence Times | System Response Time | Utilization | System Power | Synopsis

System Response Time

The global aggregate is the "System Response Time" and is obtained weighting the aggregated values by the relative per-class throughput.
A: This value of System Response Time **includes** the Residence Time of the Reference Station.
B: This value of System Response Time **does NOT include** the Residence Time of the Reference Station.
Notice: For **open classes** the Reference Station always coincides with the arrival process. Thus the **B** values are not computed.

*	*Aggregate*	Class1
A	0.5144	0.5144
B	--	--

(System Response Time)

JMVA Solutions - MVA

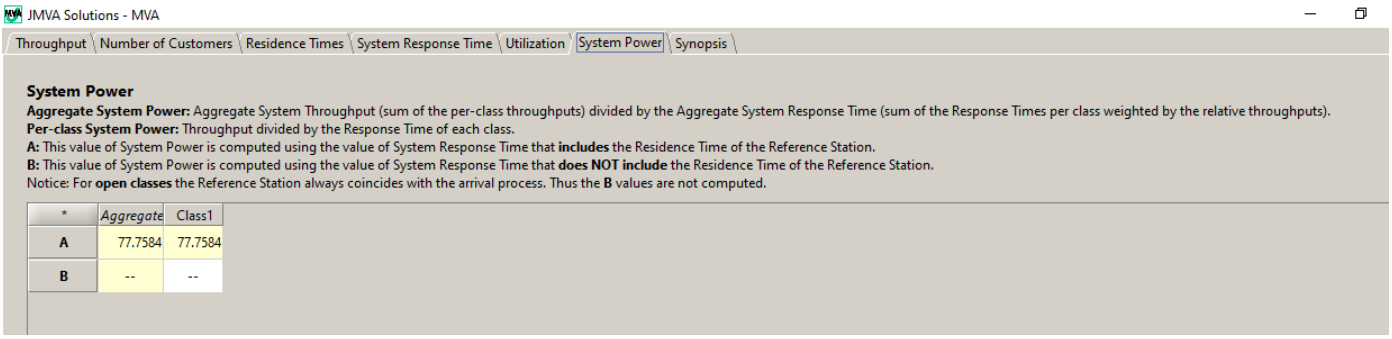
Throughput | Number of Customers | Residence Times | System Response Time | Utilization | System Power | Synopsis

Utilization

Utilization of a customer class at the selected station. The utilization of a delay station is the average number of customers in the station (it may be greater than 1).

*	*Aggregate*	Class1
Station1	0.4983	0.4983
Station2	0.7475	0.7475
Station3	0.8721	0.8721
Station4	0.7694	0.7694
Station5	0.8662	0.8662

(Utilization Results)



(System Power Results)

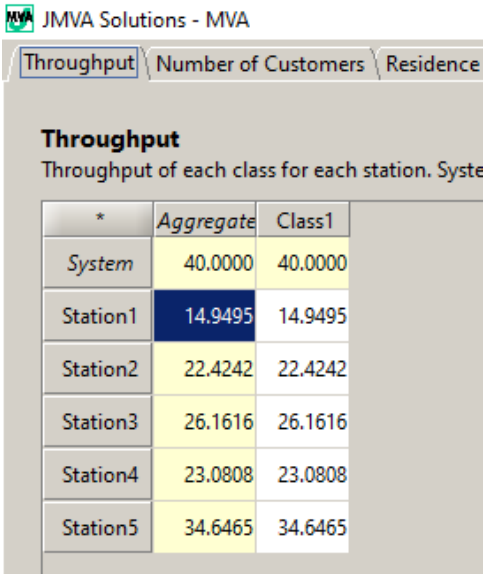
Calculations:

a - Are all the queues stable?

- *Yes the queues are stable*

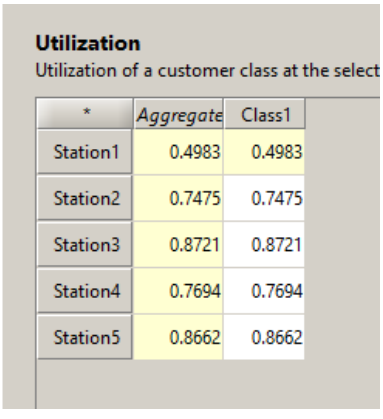
Here we can see that throughput is less than μ for every queue. $\mu 1 = \mu 2 = \mu 3 = \mu 4 = 30$ and $\mu 5 = 40$.

<u>*So all the queues are stable*</u>



c - What is the probability that a customer will get served immediately upon arrival at the food court?

P0 = 1 - ρ
ρ = 0.8662
P0 = 1 – 0.8662 = 0.1338



d - What is the mean waiting time at each theme?

- M1 = 0.0248
- M2 = 0.0740
- M3 = 0.1704
- M4 = 0.0834
- M5 = 0.1618

Residence Times

Total time spent by each customer class su

*	Aggregate	Class1
Station1	0.0248	0.0248
Station2	0.0740	0.0740
Station3	0.1704	0.1704
Station4	0.0834	0.0834
Station5	0.1618	0.1618

e - How long would it take on the average to visit all themes once, and of that time how much one spends waiting in a queue?

- Average time to visit all themes once = (0.0248 + 0.0740 + 0.1704 + 0.0834 + 0.1618) = 0.5144